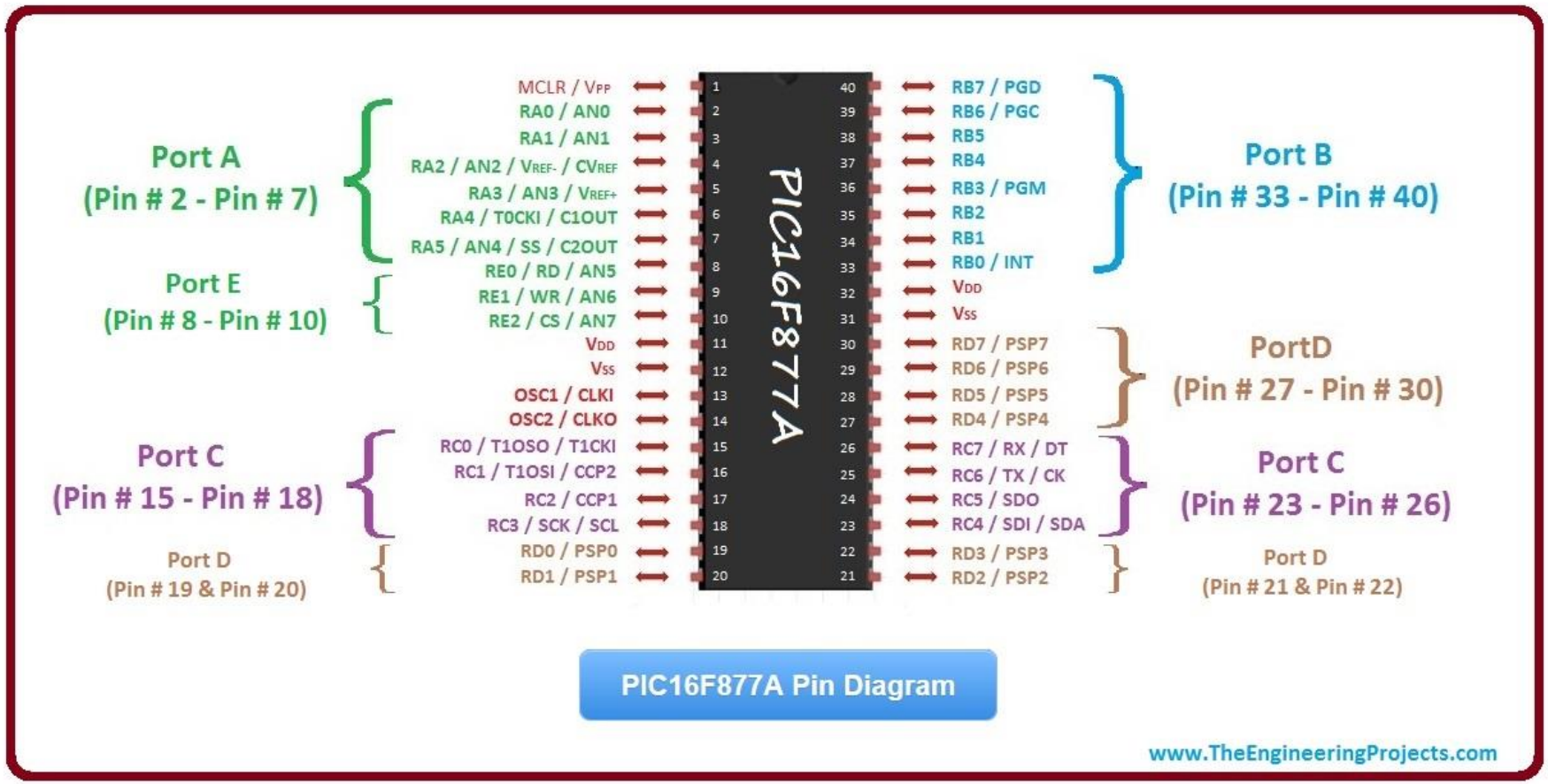
MEE427
Microcontroller Overview

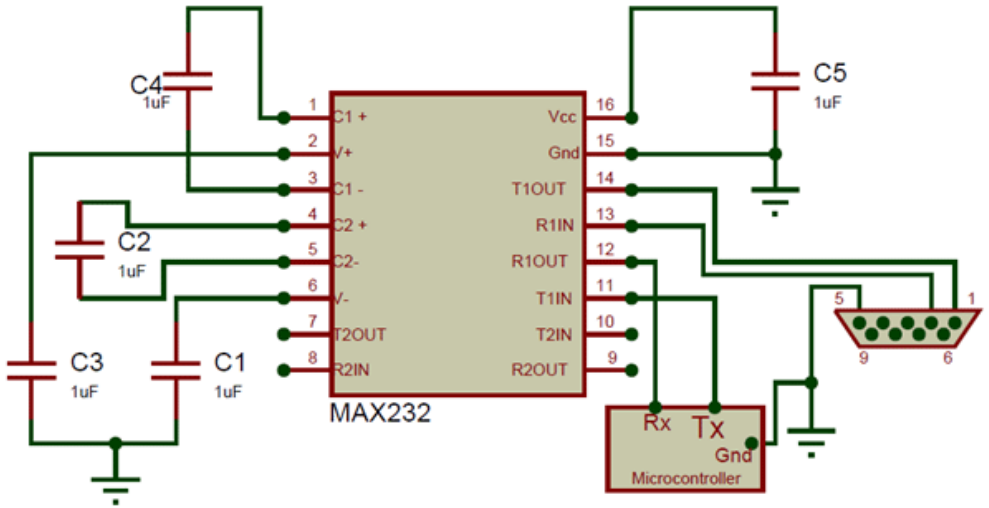
29/02/2024

PIC 16F877A


Port A
(Pin # 2 - Pin # 7)
Port E
(Pin # 8 - Pin # 10)
Port C
(Pin # 15 - Pin # 18)
Port D
(Pin # 19 & Pin # 20)
MCLR / VPP
RA0 / AN0
RA1 / AN1
RA2 / AN2 / VREF- / CVREF
RA3 / AN3 / VREF+
RA4 / T0CKI / C1OUT
RA5 / AN4 / SS / C2OUT
RE0 / RD / AN5
RE1 / WR / AN6
RE2 / CS / AN7
VDD
VSS
OSC1 / CLKI
OSC2 / CLKO
RC0 / T1OSO / T1CKI
RC1 / T1OSI / CCP2
RC2 / CCP1
RC3 / SCK / SCL
RD0 / PSP0
RD1 / PSP1
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
PIC16F877A
40 39 38 37 36 35 34 33 32 31 30 29 28 27 26 25 24 23 22 21
RB7 / PGD
RB6 / PGC
RB5
RB4
RB3 / PGM
RB2
RB1
RB0 / INT
VDD
VSS
RD7 / PSP7
RD6 / PSP6
RD5 / PSP5
RD4 / PSP4
RC7 / RX / DT
RC6 / TX / CK
RC5 / SDO
RC4 / SDI / SDA
RD3 / PSP3
RD2 / PSP2
Port B
(Pin # 33 - Pin # 40)
PortD
(Pin # 27 - Pin # 30)
Port C
(Pin # 23 - Pin # 26)
Port D
(Pin # 21 & Pin # 22)
PIC16F877A Pin Diagram
www.TheEngineeringProjects.com

Components and Software

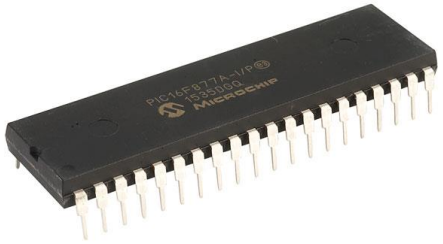
- Needed Hardware;
  - PIC 16F877A
  - PIC Programmer (available)
  - Crystal and capacitors
  - Max232 and rs232 to usb converter or FTDI Cable or Arduino Uno without chip (needed for debugging)

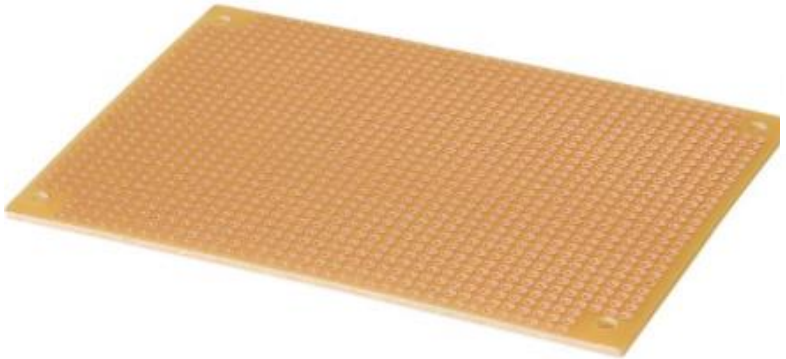


What needed as Hardware

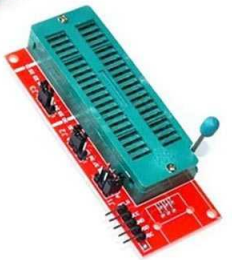
- PIC16F877A
- 40 Pin Socket
- Crystal 20MHz
- 22 pF Capacitor (x2)
- 100 µF Capacitor (x2)
- Perforated Board
- 40 pin male header
- 10kΩ Potentiometer
- 1 Tach Button
- 10k Resistor
- Fuse (2A) and Fuse Socket
- 7805 5V Regulator
- Terminal Blocks (x8)
- PIC Programmer (Available)







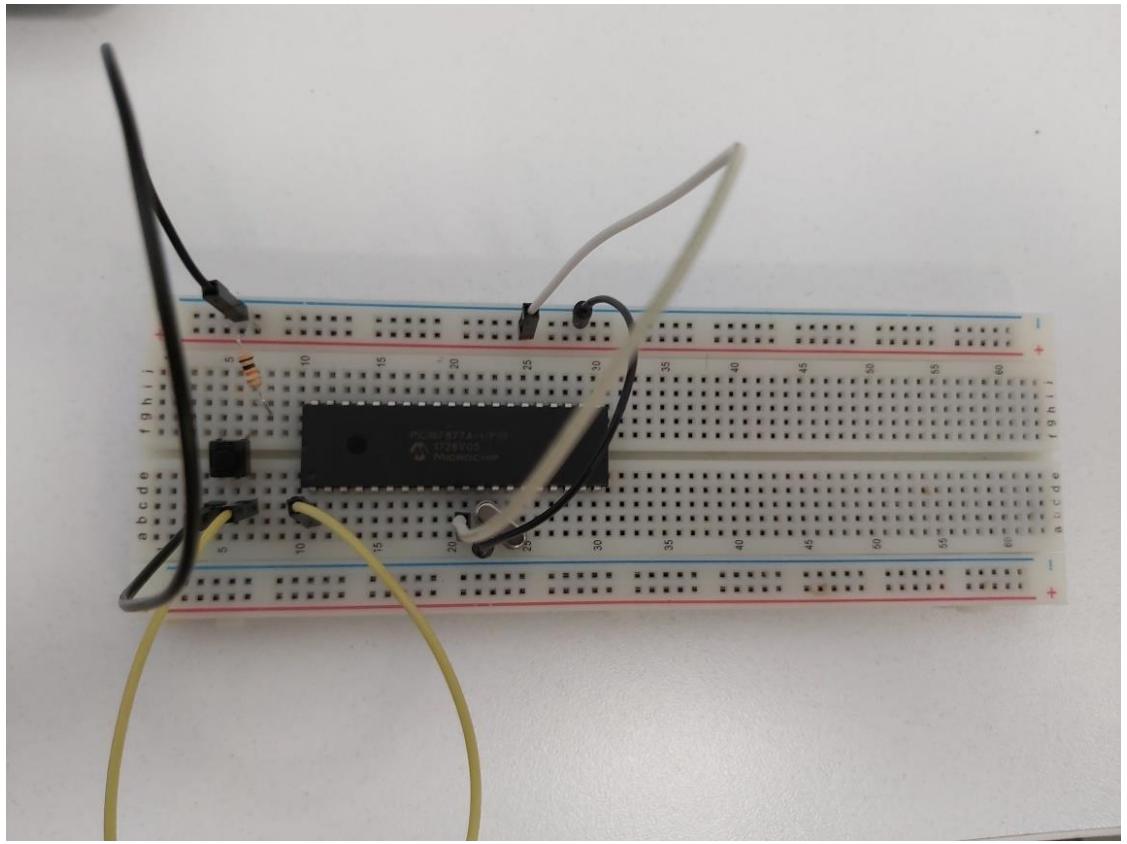



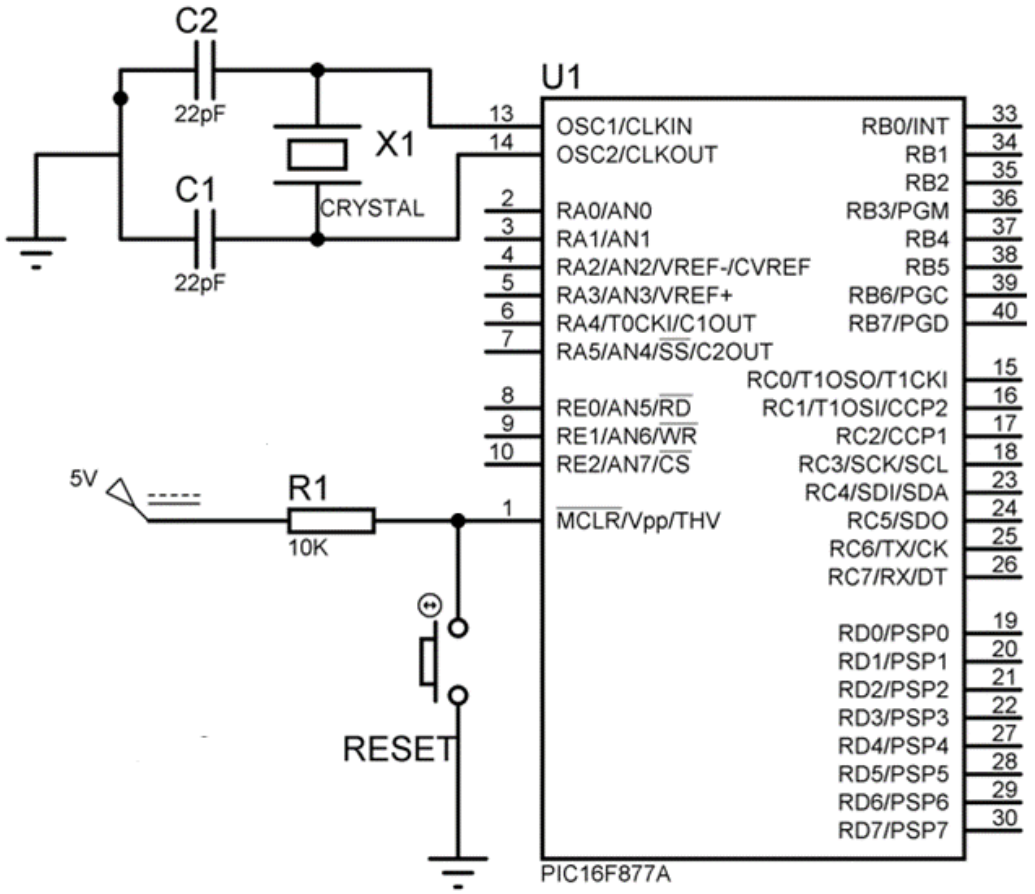
Connections

- Reset pin should be powered
- OSC1 & OSC2 should be connected to crystal and 22pF capacitors
- Programmer is connected to Reset, PGD & PGC pins.

Hardware

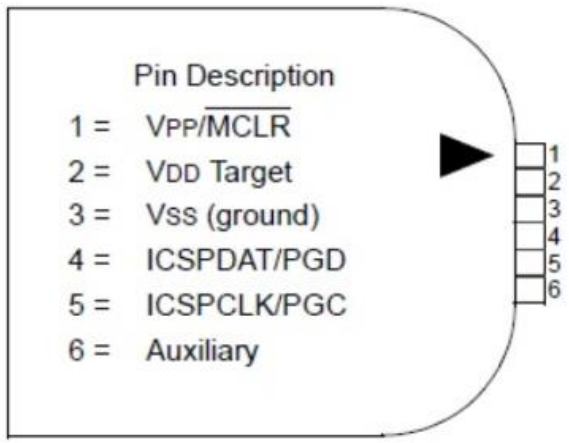
- Minimum connection for PIC16F877A

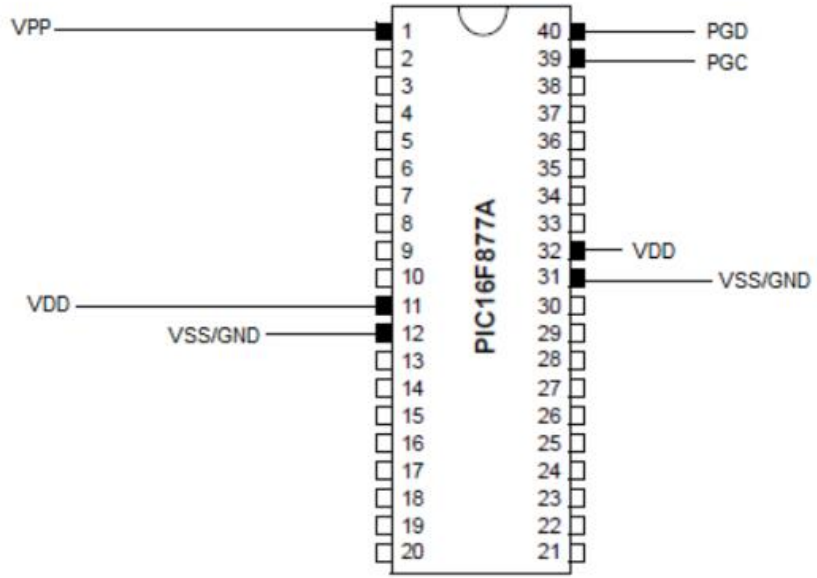


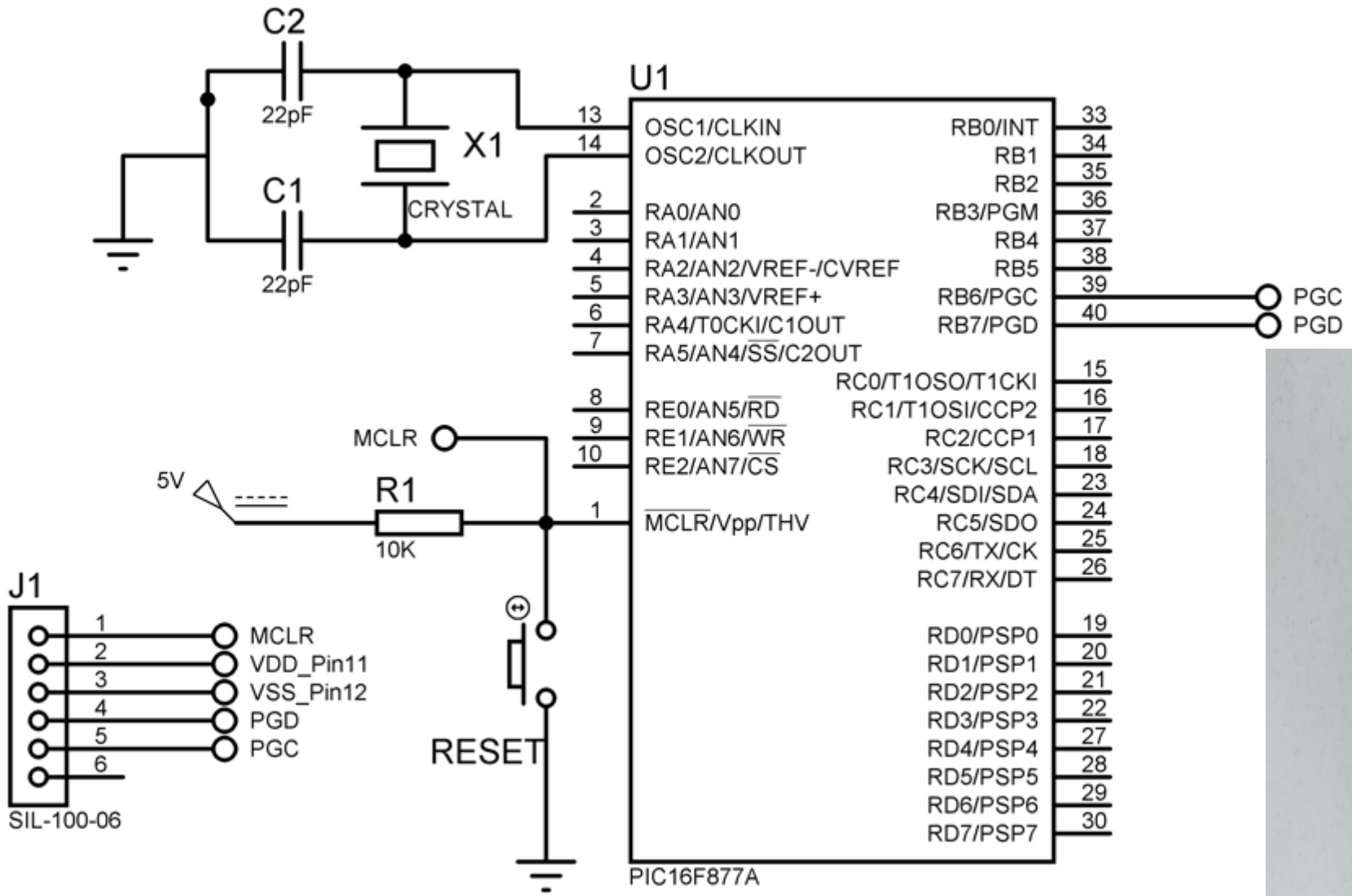


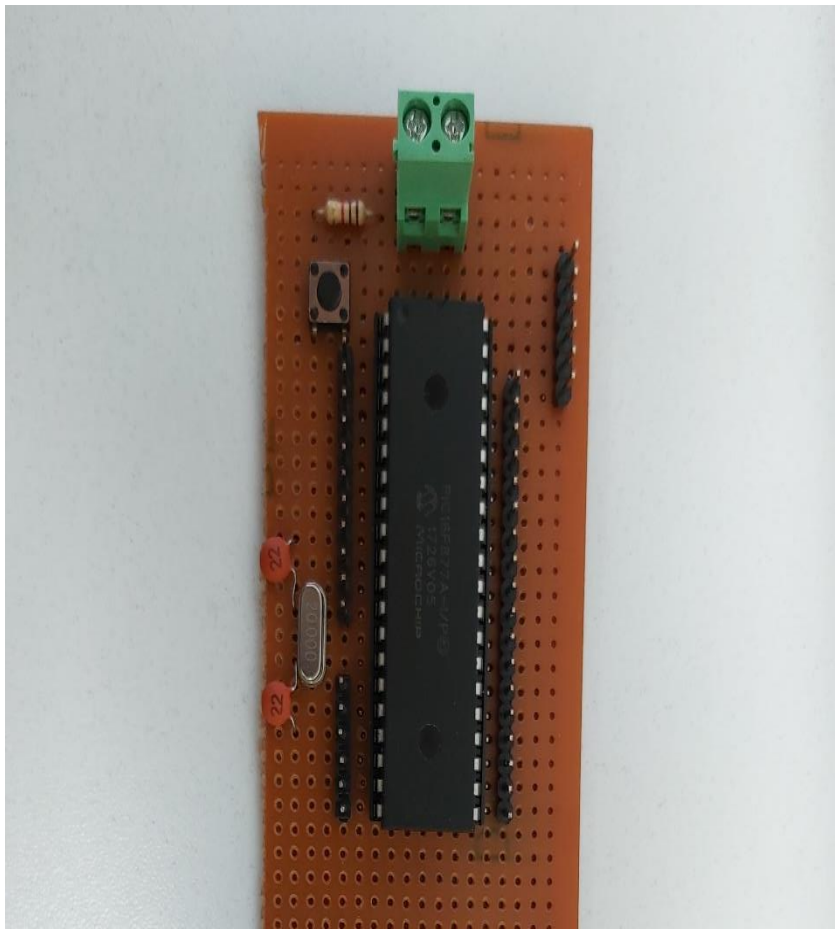
Proper PIC16F877A Custom Board

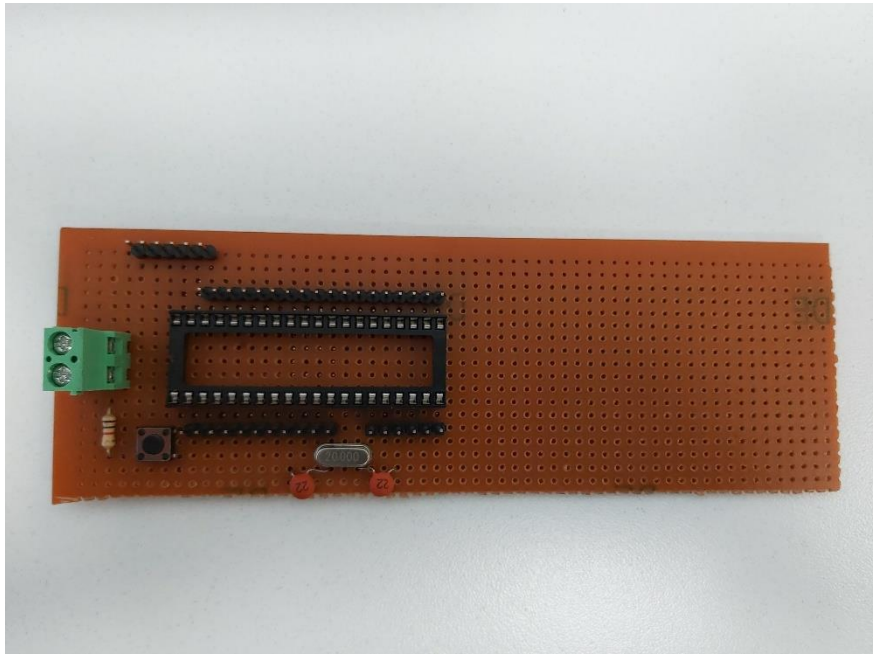
- Advantages;
  - Strong connections
  - Proper code uploading opportunity (less damage)
  - Customization possibility

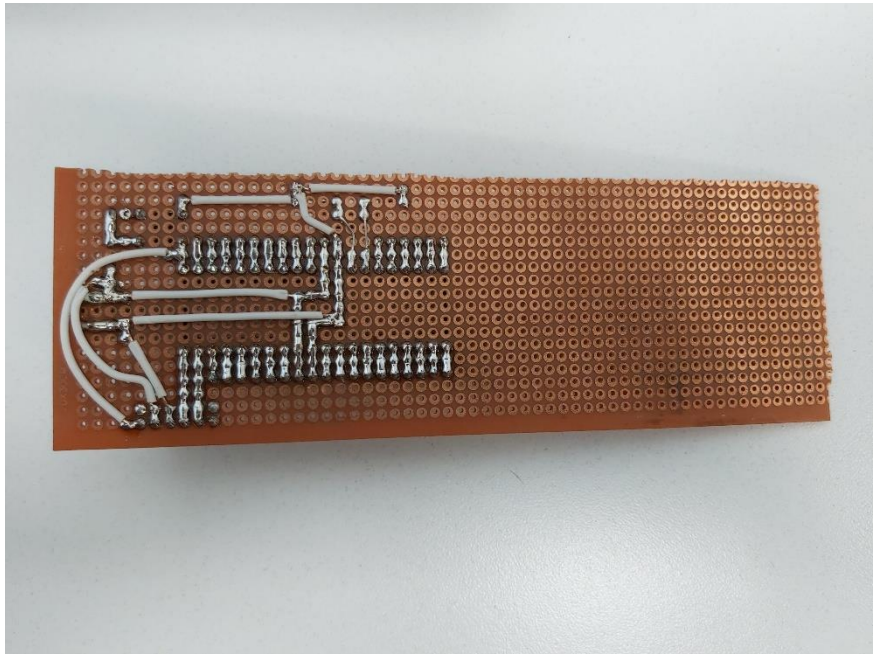




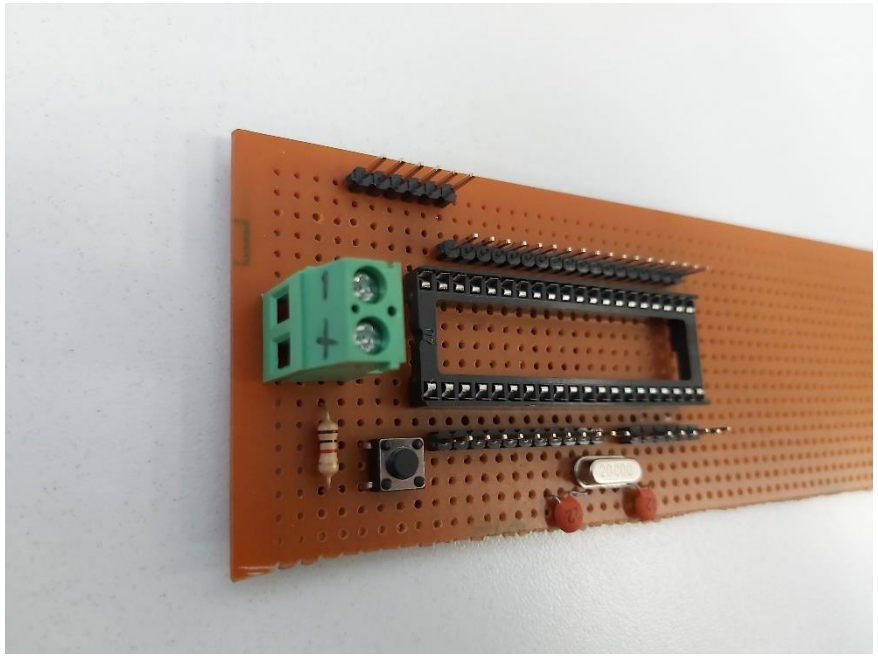

C2
22pF
X1
CRYSTAL
C1
22pF
U1
OSC1/CLKIN
OSC2/CLKOUT
RA0/AN0
RA1/AN1
RA2/AN2/VREF-/CVREF
RA3/AN3/VREF+
RA4/T0CKI/C1OUT
RA5/AN4/SS/C2OUT
RE0/AN5/RD
RE1/AN6/WR
RE2/AN7/CS
MCLR/Vpp/THV
RB0/INT
RB1
RB2
RB3/PGM
RB4
RB5
RB6/PGC
RB7/PGD
RC0/T1OSO/T1CKI
RC1/T1OSI/CCP2
RC2/CCP1
RC3/SCK/SCL
RC4/SDI/SDA
RC5/SDO
RC6/TX/CK
RC7/RX/DT
RD0/PSP0
RD1/PSP1
RD2/PSP2
RD3/PSP3
RD4/PSP4
RD5/PSP5
RD6/PSP6
RD7/PSP7
PIC16F877A
PGC
PGD
MCLR
5V
R1
10K
RESET
J1
MCLR
VDD_Pin11
VSS_Pin12
PGD
PGC
SIL-100-06

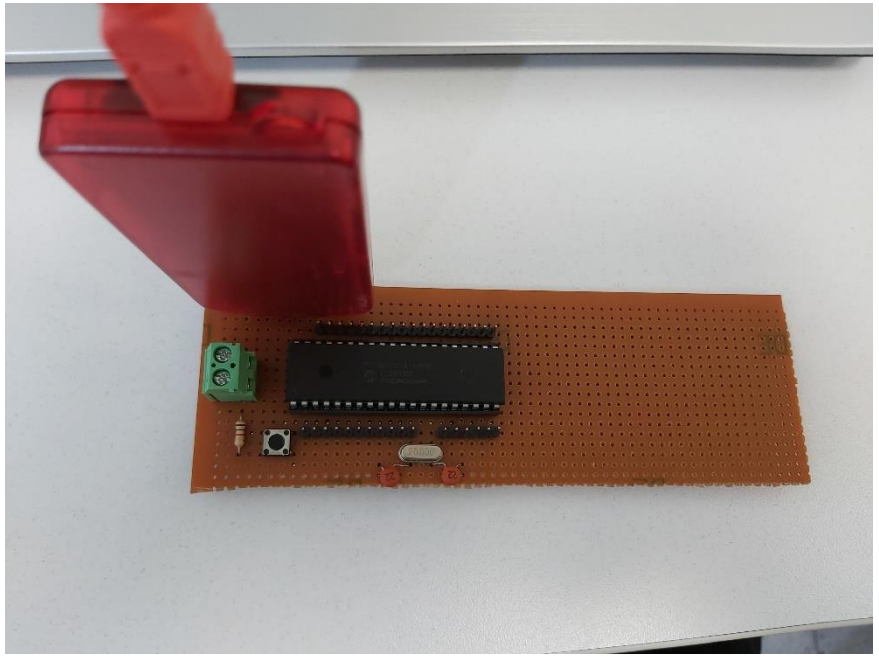







PICkit™ 3
POWER
ACTIVE
STATUS

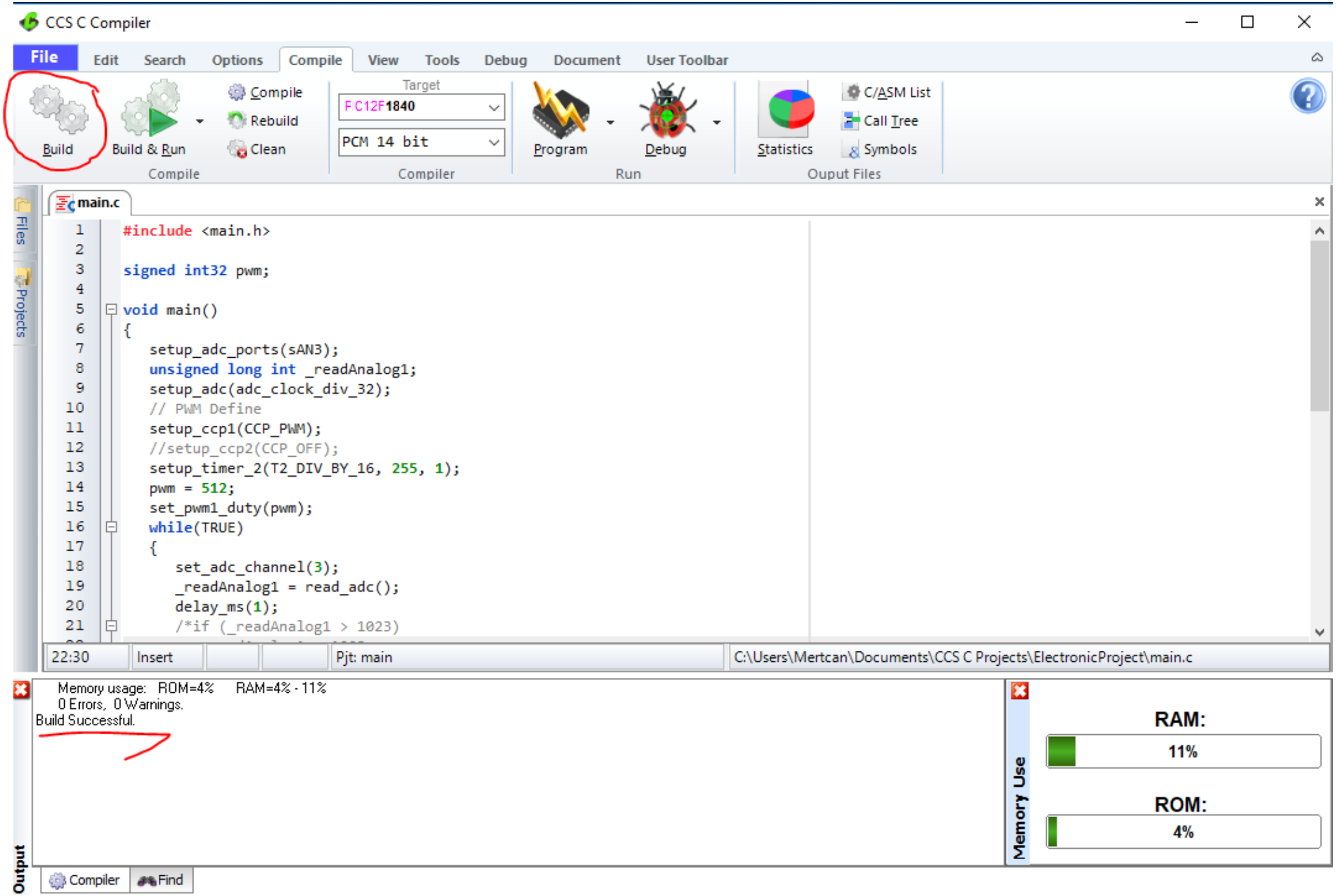


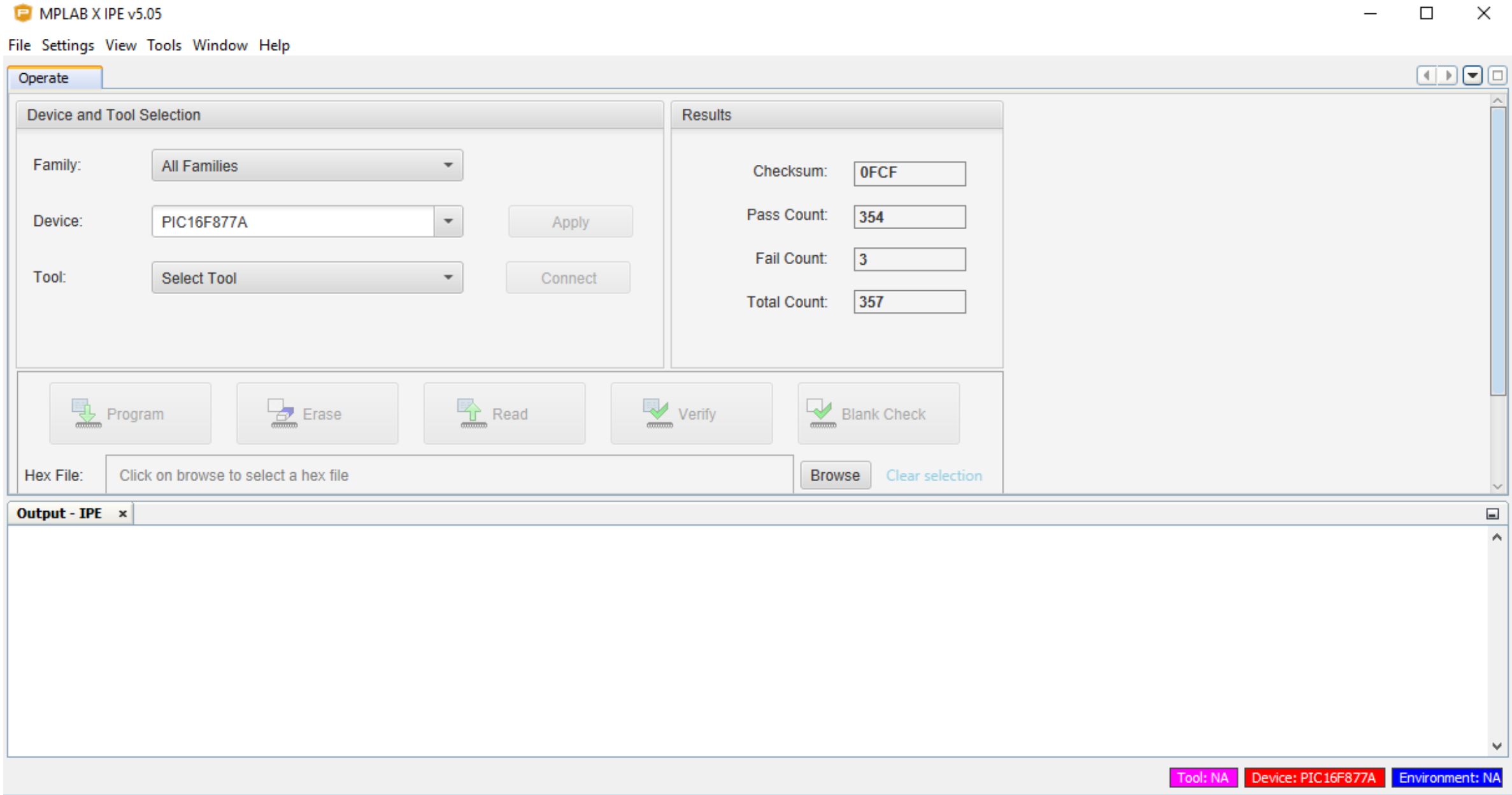


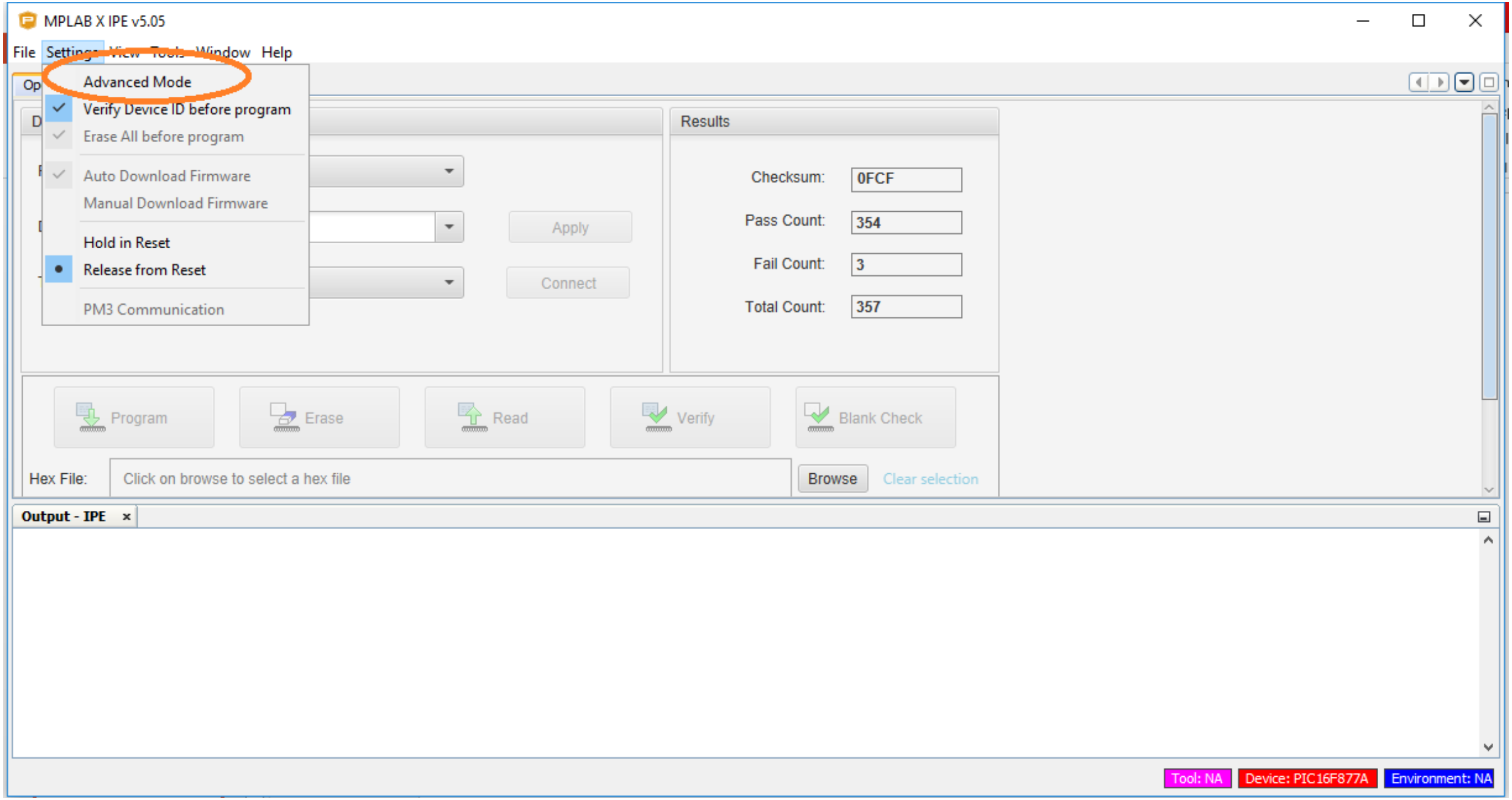
Components and Software

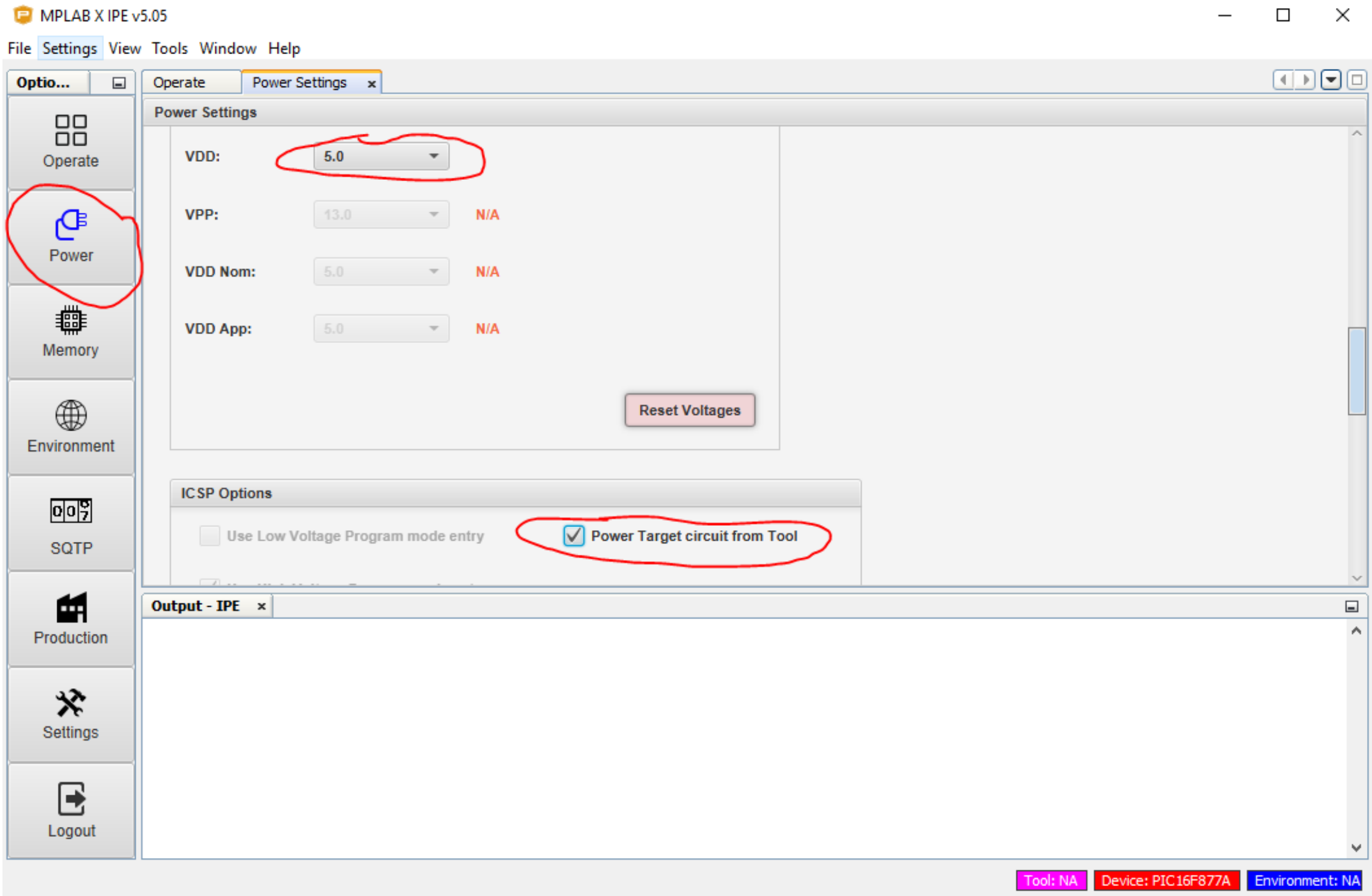
Needed Software

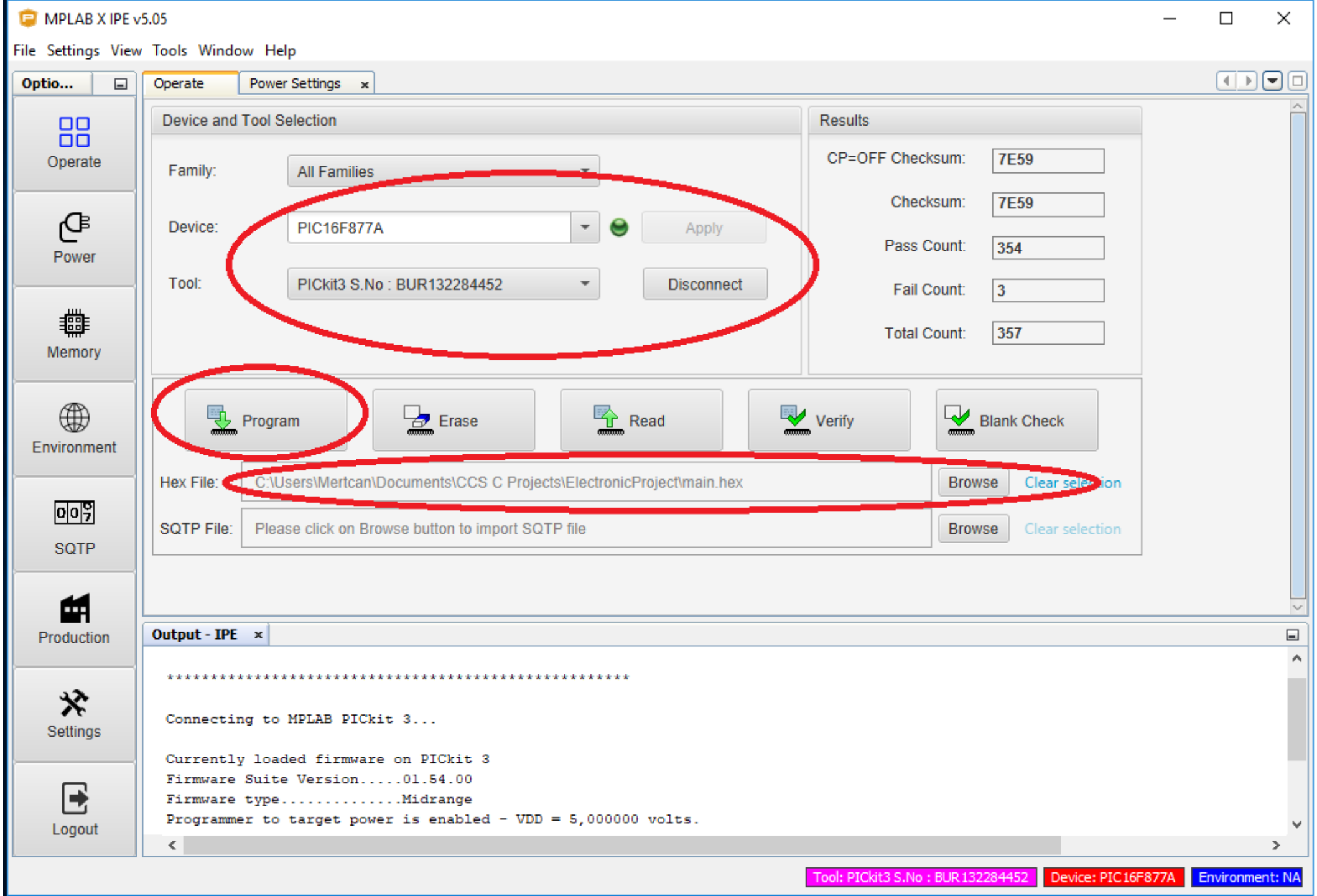
- CCS C Compiler (Coding Environment and Converter to .hex)
- Proteus (Simulation Environment)
- PIC Programmer Software
  - MPLAB X IPE
  - PICkit™ 3 Programming App and Scripting Tool


CCS C Compiler
File
Edit
Search
Options
Compile
View
Tools
Debug
Document
User Toolbar
Build
Build & Run
Compile
Rebuild
Clean
Compile
Target
PIC12F1840
PCM 14 bit
Compiler
Program
Debug
Run
Statistics
C/ASM List
Call Tree
Symbols
Ouput Files
Files
Projects
main.c
#include <main.h>
signed int32 pwm;
void main()
{
setup_adc_ports(sAN3);
unsigned long int _readAnalog1;
setup_adc(adc_clock_div_32);
// PWM Define
setup_ccp1(CCP_PWM);
//setup_ccp2(CCP_OFF);
setup_timer_2(T2_DIV_BY_16, 255, 1);
pwm = 512;
set_pwm1_duty(pwm);
while(TRUE)
{
set_adc_channel(3);
_readAnalog1 = read_adc();
delay_ms(1);
/*if (_readAnalog1 > 1023)
22:30
Insert
Pjt: main
C:\Users\Mertcan\Documents\CCS C Projects\ElectronicProject\main.c
Memory usage: ROM=4% RAM=4% - 11%
0 Errors, 0 Warnings.
Build Successful.
Output
Compiler
Find
Memory Use
RAM:
11%
ROM:
4%


MPLAB X IPE v5.05
File Settings View Tools Window Help
Operate
Device and Tool Selection
Family:
All Families
Device:
PIC16F877A
Apply
Tool:
Select Tool
Connect
Results
Checksum:
0FCF
Pass Count:
354
Fail Count:
3
Total Count:
357
Program
Erase
Read
Verify
Blank Check
Hex File:
Click on browse to select a hex file
Browse
Clear selection
Output - IPE
Tool: NA
Device: PIC16F877A
Environment: NA


MPLAB X IPE v5.05
File
Settings
View
Tools
Window
Help
Advanced Mode
Verify Device ID before program
Erase All before program
Auto Download Firmware
Manual Download Firmware
Hold in Reset
Release from Reset
PM3 Communication
Apply
Connect
Results
Checksum:
0FCF
Pass Count:
354
Fail Count:
3
Total Count:
357
Program
Erase
Read
Verify
Blank Check
Hex File:
Click on browse to select a hex file
Browse
Clear selection
Output - IPE
Tool: NA
Device: PIC16F877A
Environment: NA


MPLAB X IPE v5.05
File Settings View Tools Window Help
Optio...
Operate
Power
Memory
Environment
SQTP
Production
Settings
Logout
Operate
Power Settings
Power Settings
VDD:
5.0
VPP:
13.0
N/A
VDD Nom:
5.0
N/A
VDD App:
5.0
N/A
Reset Voltages
ICSP Options
Use Low Voltage Program mode entry
Power Target circuit from Tool
Output - IPE
Tool: NA
Device: PIC16F877A
Environment: NA


MPLAB X IPE v5.05
File Settings View Tools Window Help
Optio...
Operate
Power
Memory
Environment
SQTP
Production
Settings
Logout
Operate
Power Settings
Device and Tool Selection
Family:
All Families
Device:
PIC16F877A
Apply
Tool:
PICkit3 S.No : BUR132284452
Disconnect
Results
CP=OFF Checksum:
7E59
Checksum:
7E59
Pass Count:
354
Fail Count:
3
Total Count:
357
Program
Erase
Read
Verify
Blank Check
Hex File:
C:\Users\Mertcan\Documents\CCS C Projects\ElectronicProject\main.hex
Browse
Clear selection
SQTP File:
Please click on Browse button to import SQTP file
Browse
Clear selection
Output - IPE
****
Connecting to MPLAB PICkit 3...
Currently loaded firmware on PICkit 3
Firmware Suite Version.....01.54.00
Firmware type.....Midrange
Programmer to target power is enabled - VDD = 5,000000 volts.
Tool: PICkit3 S.No : BUR132284452
Device: PIC16F877A
Environment: NA